



Selecting and using spray adjuvants

Viti-note Summary:

- Surfactants
- Wetting agents and spreaders
- Stickers
- Penetrants and super spreaders
- Special purpose adjuvants used in viticulture
- Guidelines for using adjuvants when spraying vines

Other topics in this Viti-Notes series include:

- Targeting sprays for vineyard pests and diseases
- Maintaining product performance in spray mixes
- *Selecting and using spray adjuvants*
- Understanding chemical 'modes of action'
- Managing chemical resistance in the vineyard
- Equipment adjustment and evaluation to maximise spray coverage
- A single rate per hectare – why it shouldn't be used
- Determining chemical rates for dilute and concentrate spraying
- Determining dilute water volumes for spraying
- Calculating chemical rates for vines

Adjuvants are designed to enhance performance of the chemical product applied to control pests or diseases.

Formulation adjuvants are added by the manufacturer as part of the product. These are used to improve mixing and handling, increase safety and effectiveness of the product and improve distribution over the target. *Spray adjuvants* are added separately into the spray tank at the time of use to improve the performance of the active ingredients. There are many additives available for application of fungicides, insecticides and herbicides. These can be grouped into two broad classes:

- *Activator adjuvants* can include surfactants such as wetters, oils, stickers and penetrants. These are commonly used to increase droplet spread, improve rain fastness and increase uptake of active ingredients by plants. They enhance product performance by modifying the physical and chemical characteristics of the spray solution including density, surface tension and solubility.
- *Special purpose adjuvants* can include buffering agents, acidifiers, drift control agents and feeding attractants. These are commonly used to modify the spray solution or application conditions so that a formulation can function effectively. Sometimes they may also alter the physical characteristics of the spray solution.

Surfactants

This is a broad category of surface-acting adjuvants that improve the absorbing, emulsifying, dispersing, spreading, sticking, wetting or penetrating properties of products. Plants have a water-repellent wax (cuticle) on their outer surfaces, and surfactants are mostly

used to overcome this natural barrier so that the active ingredient becomes more effective, e.g. forming bridges between water and wax on a leaf surface, or altering the permeability of the cuticle.

Wetting agents and spreaders

These improve the wetting and coverage of foliage and grape bunches by reducing the surface tension between spray droplets and plant surfaces (this can also be described as 'changing the contact angle' of the water droplet on the leaf or berry).

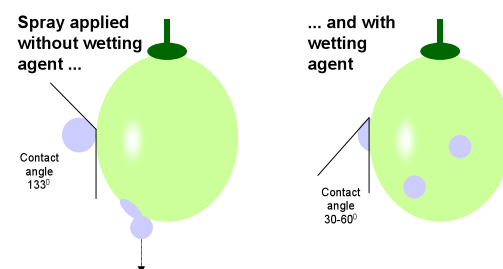


Figure 1. Contact angles without surfactants can be large, e.g. 95° on upper leaf surfaces and 133° on berries. This increases the chance of runoff and decreases the area of contact or absorption for the chemical in the water droplet.

These compounds can be non-ionic, cationic or anionic. A non-ionic wetter has no charge when dispersed in water. A cationic wetter is positively charged while an anionic wetter has a negative charge on the surface-active portion. Phenol-based non-ionic wetters are most commonly used in viticulture and are generally compatible with a wide range of products.

Stickers

Designed to enhance the retention of a spray, these adjuvants increase the adhesion of solid particles on target surfaces. They are designed to reduce the amount of product washed off during rain or irrigation and help prevent loss of the active ingredient from wind or leaf abrasion. Stickers can also reduce evaporation of water droplets and some slow ultraviolet (UV) degradation of the active ingredient. Spreader-stickers contain a wetter as well as a latex or other adhesive sticker. They are often used as a general purpose adjuvant for fungicide and insecticide applications.

Penetrants and super spreaders

These enhance the penetration and spreading of certain active ingredients into plants and are designed for use with systemic and translaminar herbicides. They are also known as organosilicone super spreaders.

Research in Australia and New Zealand has resulted in the development of 'modified organosilicones' suitable for use in viticulture. These have a lower phytotoxicity potential than traditional organosilicones and are designed for use with non-systemic products. Modified organosilicones have the potential to reduce spray volumes, increase coverage and efficacy, reduce spray drift and improve spray penetration into grape bunches. Prescriptions for viticulturists are still being developed to determine water volumes and super spreader rates required for a range of tank mixes.

Care should always be taken when using a new surfactant. Obtain expert advice before application as the interaction between a surfactant, active ingredient/s and plant surface can be complex and difficult to predict.

Special purpose adjuvants used in viticulture

Some chemical products are more stable in solutions that have a particular pH. Buffers and acidifiers are adjuvants that usually contain phosphate salts used to adjust the pH (acidity or alkalinity) of a spray solution.

- Buffers stabilise pH and tend to maintain this level even if conditions such as water alkalinity change.
- Acidifiers neutralise alkaline solutions and lower pH but do not have a buffering action.

Some pest and disease management products susceptible to alkaline hydrolysis may have a buffer already incorporated into their formulations.

Water conditioners have the ability to bind calcium and magnesium ions in hard water. Excess amounts of these ions can react with susceptible ingredients in the spray solution resulting in precipitation or negatively affect

wetting and dispersion on plant surfaces. High grade ammonium sulphate (AMS) is commonly used to soften hard water. It is particularly useful in increasing the efficacy of weak-acid herbicides such as glyphosate.

Guidelines for using adjuvants when spraying vines

- Some chemical products contain the necessary adjuvants for effective performance. This may be the case if the label does not mention use of an adjuvant.
- Some adjuvants will have effects other than those for which the product is marketed. For example, a wetter may also increase penetration of a chemical through the cuticle and reduce the droplet size produced by a nozzle at a given pressure.
- Do not use adjuvants that enhance penetration through the cuticle of plants with protectant products and contact chemicals designed to work on plant surfaces.
- Only use adjuvants developed for agricultural and viticultural uses. Avoid using detergents as wetting agents as they are ionic and likely to cause phytotoxicity in grapevines. Non-ionic adjuvants are also less likely to combine with salts in hard water.
- Adjuvant costs vary widely depending on the type and concentration of active ingredient in the product. In general, non-ionic surfactants and crop oil concentrates are the least expensive, followed by esterified seed oils and organosilicones.
- If two products have similar active ingredients but at different concentrations, the cost of each on an active ingredient basis can be calculated to determine which is the most economical (NOTE: Isopropyl alcohol and water are not active ingredients).
- The performance of spray adjuvants added to the tank mix may be affected by adjuvants already added to the product by the manufacturer. These affects are difficult to predict and new tank mixes should be tested on a limited area before full-scale use. A tank dip test can also be used to test if there is excessive wetting agent in the spray solution.
- Be aware that a wetter may be suitable for one product in the tank mix but not others. Always check the chemical label for each product used in a spray solution.
- Keep records of effective tank mixes including formulations and adjuvants used and chemical rates added to the spray solution.

Selecting and using spray adjuvants

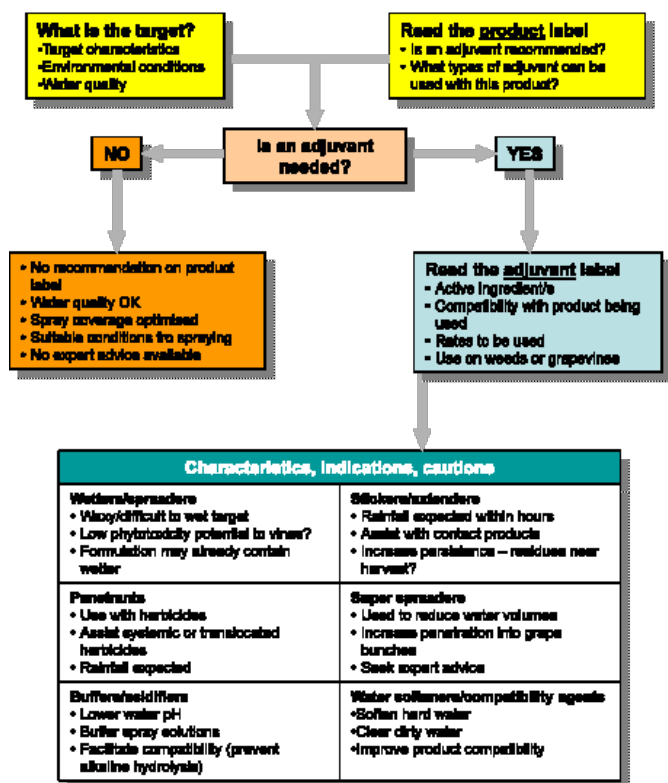


Figure 2. Decision tree for selecting adjuvants.

REMEMBER: ALWAYS CHECK THE CHEMICAL LABEL TO ENSURE THAT ADJUVANTS USED ARE COMPATIBLE WITH THE PEST OR DISEASE CONTROL PRODUCT/S BEING APPLIED. INCORRECT OR EXCESSIVE USE OF ADJUVANTS MAY REDUCE THE EFFECTIVENESS OF ACTIVE INGREDIENTS OR CAUSE DAMAGE TO VINES AND OTHER PLANTS

Acknowledgement

The Australian Wine Research Institute would like to acknowledge:

- Cooperative Research Centre for Viticulture (CRCV) and all involved in the VitiNotes series (1996 - 2006).

Further information

Innovator network factsheets

Spray application by Alison MacGregor

http://www.gwrdc.com.au/webdata/resources/files/GWR_070_Spray_Application_Fact_Sheet_FINAL_WEB.pdf

Training

For regional specific training in pest and disease control, the AWRI is running Research to Practice: Integrated Pest Management for changing viticultural environments.

Contact

Marcel Essling: rtp@awri.com.au for more information.

Agrochemical information

Agrochemicals registered for use in Australian Viticulture - updated annually.

Visit www.awri.com.au for the latest version.

Useful references

Nicholas, P., Magarey, P.A. and Wachtel, M. (Eds.) 1994 Diseases and pests, Grape Production Series 1, Hyde Park Press, Adelaide (a glove box edition of this book is also available).

For images of grapevine symptoms visit www.winetitles.com/diagnosis/index.asp.



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